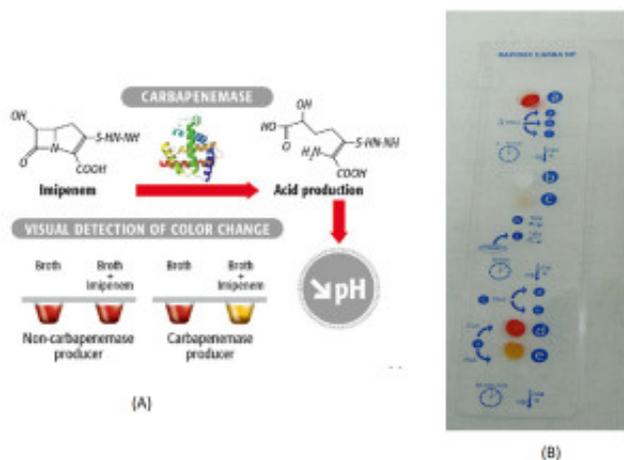


## Tests for biochemical detection of carbapenemase-producing Enterobacteriaceae

Multidrug resistance (MDR) to antibiotic in bacteria is becoming now a major issue worldwide. Its development worldwide may comprise the efficacy of the modern medicine such as transplantation, heavy surgery or hospitalization in intensive care units. Therefore, many important public bodies have raised an alarm signal on the rapid spread of MDR bacteria such as the US Presidency in the USA. They underline the need to develop rapid diagnostic tests for identification of antibiotic-resistant bacteria, a better antibiotic stewardship and the prevention of the spread of nosocomial MDR bacteria. The most clinically-significant MDR bacteria are currently *Enterobacteriaceae* such as *Escherichia coli* and *Klebsiella pneumoniae* producing carbapenemases. Carbapenemases are enzymes that inactivate the latest developed broad-spectrum  $\beta$ -lactams, carbapenems (imipenem, meropenem, ertapenem...), used as late resort antibiotics. So far, detection of carbapenemase producers relied on conventional antibiotic susceptibility testing that takes 24 h or on molecular based techniques. Although molecular techniques are efficient, they detect only a few on known carbapenemase genes and they remain quite expensive.



Principle of the Carba NP test (A) and the Rapidec Carba NP test (B)

Therefore, we had developed the very first rapid diagnostic test for identification of carbapenemase producers, the Carba NP test that is a biochemical test (Fig, panel A). It detects any type of carbapenemase activity (carbapenemases of class A [KPC], class B [IMP, VIM, NDM], class D [OXA-48]) by monitoring the color change of a pH indicator according to hydrolysis of the substrate, imipenem (Fig, panel A). It is rapid, easy-to handle, and cost effective. However, it remains an home-made technique. Consequently, we have evaluated the performances of two commercially-available test derivatives of the Carba NP test , the Rapidec Carba NP<sup>®</sup> test (Fig, panel B), and the Rapid Carb Screen<sup>®</sup>, as compared to the Carba NP test with a collection of 150 genetically-

characterized clinical strains of *Enterobacteriaceae* including 132 with a decreased susceptibility to carbapenems. Sensitivity and specificity were 99 and 100% for the RAPIDEC® CARBA NP test, 89.5% and 70.9% for the Rapid CARB Screen and 96.8% [and 100% for the Carba NP test, respectively. The RAPIDEC® CARBA NP possesses the best performances for a rapid and efficient detection of carbapenemase-producing *Enterobacteriaceae*. It is a rapid (1h, mostly 30 min), affordable (less than 10 USD) and an easy-to-handle diagnostic test. It is able to detect any kind of carbapenemase activity (known and unknown). It will find its place as a first line screening of carbapenemase producers in clinical settings. It will contribute to (i) the follow up of the spread of carbapenemase producers in a given territory (ii) the identification of outbreaks and therefore their prevention (iii) an dthe antibiotic stewardship including the choice of treatment with totally novel drugs such as the combination of ceftazidime/avibactam.

## **Publication**

[Evaluation of the RAPIDEC® CARBA NP, the Rapid CARB Screen® and the Carba NP test for biochemical detection of carbapenemase-producing \*Enterobacteriaceae\*.](#)

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